

Appl. No. 09/270,780
Amendment After Final dated September 1, 2004
Reply to Office Action of June 1, 2004

REMARKS

Claims 1-3, 5-22, 25, 26, 29, 30 and 33-34 are pending in this application. No claim has been amended herein.

Base claims 1, 13 and 20 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over what the Examiner alleges as "Applicant admitted prior art" in view of Weber et al., U.S. Patent No. 6,025,897 for reasons stated on pages 2-4 of the Office Action (Paper No. 20040521). Previously, the Examiner cited individual elements from two different embodiments of a conventional LCD device, as shown in FIG. 35 and FIG. 36 of Applicants' disclosure, and then cited column 9, lines 43-67, FIG. 11 of Weber '897, as a secondary reference, for allegedly disclosing that,

"the optically structure layer (113) and structure surface (112) (also can be a light control element, because the function is to control light), and with the reflective polarizer (116) to make up a brightness enhanced reflective polarizer (110), and the light transmitted by optically structure layer (113) passes through the reflective polarizer (116) at near normal angle (perpendicular to reflective polarizer), so that is a polarized light transmission axis of the reflective polarizer to be adjusted substantially perpendicular to a control axis of the light control element, so as to enhance the brightness and to achieve an adequate contrast for the display"

in order to support an assertion that "it would have been obvious ... to arrange such reflective polarizer in which the polarized light transmission axis of the reflective polarizer is adjusted so as to be substantially perpendicular or in parallel to the control axis of the light control element as claimed in claims 1, 13 and 20 for achieving maximum light transmittance and widen the viewing angle."

Confronted with Applicants' arguments presented in the Amendment filed on May 14, 2004, as to how the cited FIG. 35 and FIG. 36 are directed to two different embodiments of conventional LCD devices, that are not compatible and, cannot be

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combined in the manner suggested by the Examiner, the Examiner has now shifted his position, citing only FIG. 35 (AAPA) for allegedly disclosing a liquid crystal display device comprising:

- an illumination device (51,53,54,56) ;
- a light control element (40) arranged at a projected light side of the illumination device ;
- a reflective polarizer (30) arranged at an upper portion of the light control element (40);
- the light control element (40) is the only light control element arranged between the illumination device (51,53,54,56) and the reflective polarizer (30);

The Examiner has also admitted that FIG. 35 does not disclose that,

the polarizer light transmission axis of the reflective polarizer is adjusted so as to be substantially perpendicular or substantially parallel to a control axis of the light control element. (Note: the "a control axis of the light control element" can be any light control axis such as the direction of a light reflection, light transmission or light birefringence as long as a light being controlled.)

Nevertheless, the Examiner continues to cite column 9, lines 43-67, FIG. 11 of Weber '897, as a secondary reference, for allegedly disclosing that,

"the optically structure layer (113) and structure surface (112) (that is a light control element, because the function is to control light), and the reflective polarizer (116) to make up a brightness enhanced reflective polarizer (110), and the light transmitted by optically structure layer (113) passes through the reflective polarizer (116) at near normal angle (perpendicular to the reflective polarizer), so that is a polarized light transmission axis of the reflective polarizer to be adjusted substantially perpendicular to a control axis of the light control element, so as to enhance the brightness and to achieve an adequate contrast. Weber also discloses (col. 8, line 44 – col. 9, line 27; Figs. 9, 10) that the light has a correct polarization to match the transmission axis of the polarizer (rear polarizer of the LCD) so as to make more efficient use of the light made available by optical cavity (140) (illumination device)). Therefore, the polarized light transmission axis of the reflective polarizer is parallel to a major axis direction of a pixel, so as to achieve more efficient light usage."

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However, these assertions are incorrect. Features of Applicants' base claims 1, 13 and 20 are not disclosed or suggested as asserted by the Examiner, by what the Examiner alleges as "Applicant Admitted Prior Art" (shown in FIG. 35) in view of Weber et al., U.S. Patent No. 6,025,897, whether taken individually or in combination. Therefore, Applicants respectfully traverse the rejection for reasons discussed herein below.

First of all, and as previously discussed, FIG. 35 shows an embodiment of a conventional LCD device in which a light control element 40 is used between a reflective polarizer 30 and an illumination device 51. However, the direction of the stripes of the light control element 40 intersects at angle of 45 degrees with a transmission axis 31 of the polarized light of the reflective polarizer 30. As a result, the polarization conversion efficiency is decreased significantly because "the polarizing conversion cannot be performed effectively by only a single reflection with the conventional composition ... Consequently, the absorption by the respective components is increased." See page 28, line 8 extending to page 29, line 12 of Applicants' disclosure.

In contrast to the background art, as shown in FIG. 35 of Applicants' disclosure, Applicants' disclosed invention seeks to address noted deficiencies of the conventional LCD device, as shown FIG. 35. Specifically, Applicants' independent claims 1, 13 and 20 each also defines the use of a single light control element arranged at a projected light side of the illumination device in order to increase transmittance of the display light. However, in order to enhance the polarizing conversion efficiently, the polarized light transmission axis of the reflective polarizer [must be] adjusted so as to be substantially perpendicular or substantially parallel to

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a control axis of the light control element. This feature is critical to Applicants' base claims 1, 13 and 20 because the polarized light conversion efficiency can now be improved and the polarized light transmission rate can be increased by making the conversion axis of the optical path conversion element intersect perpendicularly with the polarized light transmission axis of the reflective polarizer. Such reasons are expressly described on page 29, line 13 extending to page 30, line 25 of Applicants' substitute specification. As a result, the conversion axis of the light control element is intercrossed perpendicularly with the polarized light transmitting axis of the reflective polarizer so as to improve the polarized light conversion efficiency and the polarized light transmittance.

Nowhere in FIG. 35 is there any identification or recognition of the problems that are addressed by Applicants' base claims 1, 13 and 20, that is, the polarized light transmission axis of the reflective polarizer is adjusted so as to be substantially perpendicular or substantially parallel to a control axis of the light control element. As a result, the conversion axis of the light control element is intercrossed perpendicularly with the polarized light transmitting axis of the reflective polarizer so as to improve the polarized light conversion efficiency and the polarized light transmittance, as shown, for example, in FIG. 5.

Weber '897, as a secondary reference, does not remedy the noted deficiencies of FIG. 35, in order to arrive at Applicants' base claims 1, 13 and 20. This is because Weber '897 simply discloses the use of a multiple layer reflective polarizer 12, as shown in FIG. 4, intended to provide adequate brightness and contrast under both ambient and backlight illumination. As shown in FIG. 2, multiple polarizers such as a front polarizer 18 and a rear polarizer 23 are also used.

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As previously discussed, the Examiner cites column 9, lines 43-67, FIG. 11 of Weber '897, as a secondary reference, for allegedly disclosing that,

"the optically structure layer (113) and structure surface (112) (also can be a light control element, because the function is to control light), and with the reflective polarizer (116) to make up a brightness enhanced reflective polarizer (110), and the light transmitted by optically structure layer (113) passes through the reflective polarizer (116) at near normal angle (perpendicular to reflective polarizer), so that is a polarized light transmission axis of the reflective polarizer to be adjusted substantially perpendicular to a control axis of the light control element, so as to enhance the brightness and to achieve an adequate contrast for the display."

However, the Examiner's citation is misplaced. On column 8, line 64 to column 9, line 27, Weber '897 discloses a theory of enhancing brightness by adjusting the transmission axis of absorptive polarizer with the transmission axis of reflective polarizer. Weber '897 is completely silent as to whether the polarized light transmission axis is perpendicular or parallel to the control axis of light control element.

Nevertheless, on page 15 of the final Office Action (Paper No. 20040521), the Examiner disputes Applicants' arguments and cites column 8, line 44 extending to column 9, line 67, FIG. 9 and FIG. 10 of Weber '897 for allegedly disclosing that "the polarized light transmission axis is perpendicular or parallel to the control axis of the light control element". However, this citation is misplaced. FIG. 9 and FIG. 10 do not show any "polarized light transmission axis is perpendicular or parallel to the control axis of the light control element" as alleged.

Rather, FIG. 9 of Weber '897 shows a portion of the schematic optical display 164 in which a brightness enhanced reflective polarizer 110, and a dichroic absorptive polarizer 150 are used to show light that has the correct polarization to match the

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transmission axis of the dichoric absorptive polarizer 150 for brighter display. Likewise, FIG. 10 shows an optical display 170 in which a liquid crystal matrix 147 is placed between a front polarizer 149 and a rear polarizer 150. Again, both FIG. 9 and FIG. 10 refer to matching the transmission axis of a dichoric absorptive polarizer 150, and not a control axis of the light control element. In fact, nowhere in FIG. 9 nor FIG. 10 and the corresponding text of Weber '897 is there any disclosure of "a polarized light transmission axis [of the reflective polarizer must be adjusted so as to be] perpendicular or parallel to the control axis of the light control element [arranged at a projected light side of the illumination device]" as expressly defined in each of Applicants' base claims 1, 13 and 20.

As a result, even if Weber '897 is to be incorporated into FIG. 35, as suggested by the Examiner, the proposed incorporation still does not arrive at Applicants' base claims 1, 13 and 20. Therefore, in view of the foregoing deficiencies of the Examiner's proposed combination and the explanations provided above, Applicants respectfully request that the rejection of claims 1, 13 and 20 be withdrawn.

Dependent claims 2-3, 5-7, 10-12, 14, 17-18 and 22 have been rejected under 35 U.S.C. §103(a) as being unpatentable over what the Examiner alleges as "Applicant admitted prior art" and Weber et al., U.S. Patent No. 6,025,897, as applied to claims 1, 13 and 20, and further in view of Gunjima et al., U.S. Patent No. 5,587,816 for reasons stated on pages 4-8 of the final Office Action (Paper No. 20040521). Similarly, dependent claims 9 and 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over what the Examiner alleges as "Applicant admitted prior art" and Weber et al., U.S. Patent No. 6,025,897, as applied to claims

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1, 13 and 20, and further in view of Wortman et al., U.S. Patent No. 6,101,032 for reasons stated on pages 8-9 of the final Office Action (Paper No. 20040521). Since these rejections are predicated upon the correctness of the rejection of Applicants' base claims 1, 13 and 20, Applicants respectfully traverse these rejections for the same reasons discussed against the rejection of Applicants' base claims 1, 13 and 20.

Separately, base claims 11 and 19 [which have previously been allowed] have now been rejected under 35 U.S.C. §103 as being unpatentable over what the Examiner alleges as "Applicant admitted prior art" in view of Gunjima et al., U.S. Patent No. 5,587,816, for reasons stated on pages 9-11 of the final Office Action (Paper No. 20040521). Specifically, in support of the rejection of Applicants' base claims 11 and 19, the Examiner asserts that,

the AAPA discloses (the "background of the invention" paragraph in the specification; conventional liquid crystal display device of FIG. 35) that a liquid crystal display device comprising:
an illumination device (51,53,54,56);
a light control element (40) arranged at a projected light side of the illumination device;
a reflective polarizer (30) arranged at an upper portion of the light control element (40);
a liquid crystal display element (20) for controlling polarization of projected light projected from the reflective polarizer (30);
a screen (10AA) arranged at an upper portion of the liquid crystal display element (Fig. 32).

The Examiner then admits that "AAPA does not expressly disclose that,

"a liquid crystal layer interposed between a pair of transparent substrates, and between a pair of absorption polarizer, and the projected light having an angle range for the brightness become $\frac{1}{2}$ of a peak value satisfies a certain relationship."

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However, the Examiner cites column 12, line 11 – column 13, line 44 and FIG.

1 of Gunjima '816 for allegedly disclosing,

"a liquid crystal display (11) disposed between a pair of absorbing polarizers (9, 12) and the liquid crystal display must have a pair of transparent substrate for transmit light and using the light polarization to increase the transmittance so as to increase the brightness. Gunjima also discloses (col. 7, line 35 – col. 12, line 10) that the polarization function of the multi-layer structure operates most effectively when the angle of incident is at Brewster's angle, and the function of sending the light which is incident on the edge portion of the light guide to the inside of the light guide (illumination device) is determined in accordance with the material employed, and Gunjima discloses (col. 10, lines 20-40) that a total reflection angle $\theta = \sin^{-1}(1/n) = 42.2^\circ$."

However, the Examiner's assertion is severely flawed. Applicants' base claims 11 and 19 further define a liquid crystal display element as including:

at least a pair of transparent substrates;
 a liquid crystal layer interposed between the pair of transparent substrates; and
 a pair of absorption type polarizers arranged so that the pair of transparent substrates are held between pair of absorption type polarizers; and
 wherein a half-value width of projected light θ_1 (an angular range wherein a brightness becomes 1/2 of a peak value) from the illumination device in at least a certain direction satisfies a relationship expressed by the following equation:

$$\theta_1 \leq \sin^{-1}(n \cdot \sin(\tan^{-1}(2d/t)))$$

 where
 t is a thickness of each of the pair of transparent substrates,
 n is a refractive index of each of the pair of transparent substrates, and
 d is a length of the pixel in a minor axis direction of the pixel.

Nowhere on pages 9-11 of the final Office Action (Paper No. 20040521) is there an indication that the Examiner has addressed these features of Applicants' base claims 11 and 19. On page 10 of the final Office Action (Paper No. 20040521), the Examiner cites column 10, lines 20-40 of Gunjima '816 for using the equation:

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$\theta_c = \sin^{-1}(1/n) = 42.4^\circ$ to obtain the angle of incident light.

However, this equation has absolutely nothing to do with Applicants' claimed "half-value width of projected light θ_1 (an angular range wherein a brightness becomes 1/2 of a peak value) from the illumination device in at least a certain direction satisfies a relationship expressed by the following equation:

$$\theta_1 \leq \sin^{-1}(n \cdot \sin(\tan^{-1}(2d/t)))$$

where:

t is a thickness of each of the pair of transparent substrates,

n is a refractive index of each of the pair of transparent

substrates,

and

d is a length of the pixel in a minor axis direction of the pixel" as

currently defined in each of Applicants' base claims 11 and 19.

Therefore, in view of the foregoing deficiencies of the Examiner's proposed combination and the explanations provided above, Applicants respectfully request that the rejection of claims 1 and 19 be withdrawn, and that claims 11 and 19 be placed in condition for allowance as indicated previously.

Lastly, claims 25, 29 and 33 have now been rejected under over what the Examiner alleges as "Applicant admitted prior art" in view of Weber, U.S. Patent No. 6,025,897 and, Nakamura et al., U.S. Patent No. 5,986,723 for reasons stated on pages 11-13 of the final Office Action (Paper No. 20040521). However, Applicants' base claims 25, 29 and 33 further define the specific relationship between the pixel length in the major axis direction relative to the pixel length in the minor axis direction as being "substantially 3:1". Specifically, Applicants' base claims 25, 29 and 33 define "wherein a ratio of length of the pixel in the major axis direction to a length of the pixel in a minor axis direction of the pixel is substantially 3:1."

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On page 13 of the final Office Action (Paper No. 20040521), the Examiner cites column 1, line 66 extending to column 2, line 53, and FIG. 17 of Nakamura '723 for allegedly disclosing Applicants' claimed "ratio of length of the pixel in the major axis direction to a length of the pixel in a minor axis direction of the pixel is substantially 3:1" as defined in base claims 25, 29 and 33.

However, the Examiner's citation is also misplaced and completely out of context. FIG. 17 of Nakamura '723 shows a LCD device with a hologram optical element (HOE) 102 used to separate optical rays from the incident light, focalize them on its focal plane, and form a continuous spectrum distribution. The HOE 102 is provided with a set of pixels corresponding to R, G and B colors. For each pixel, the pixel length and breadth (width) ratio is 3:1. However, such pixel length and breadth has nothing to do with Applicants' claimed "ratio of length of the pixel in the major axis direction to a length of the pixel in a minor axis direction of the pixel is substantially 3:1" as defined in Applicants' base claims 25, 29 and 33.

Therefore, in view of the foregoing deficiencies of the Examiner's proposed combination and the explanations provided above, Applicants respectfully request that the rejection of claims 25, 29 and 33 be withdrawn, and that claims 25, 29 and 33 be placed in condition for allowance as indicated previously.

In view of the foregoing amendments, arguments and remarks, all claims are deemed to be allowable and this application is believed to be in condition to be passed to issue. Should any questions remain unresolved, the Examiner is requested to telephone Applicants' attorney at the Washington DC area office at (703) 312-6600.

INTERVIEW:

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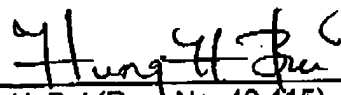
In the interest of expediting prosecution of the present application, Applicants respectfully request that an Examiner interview be scheduled and conducted. In accordance with such interview request, Applicants respectfully request that the Examiner, after review of the present Amendment, contact the undersigned local Washington, D.C. area attorney at the local Washington, D.C. telephone number (703) 312-6600 for scheduling an Examiner interview, or alternatively, refrain from issuing a further action in the above-identified application as the undersigned attorneys will be telephoning the Examiner shortly after the filing date of this Amendment in order to schedule an Examiner interview. Applicants thank the Examiner in advance for such considerations. In the event that this Amendment, in and of itself, is sufficient to place the application in condition for allowance, no Examiner interview may be necessary.

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage of fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, No. 01-2135 (Application No. 503.36984X00), and please credit any excess fees to said deposit account.

Respectfully submitted,

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